REMARKS

Claims 1 and 3-33 are pending. Claim 2 was previously canceled. Claim 19 has been amended for clarity without changing the scope of the claim. Applicants respectfully request reconsideration of the application in response to the final Office action.

Allowable Subject Matter

Claims 4, 9-15, 19-20, 26-27, and 29 have been objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. Applicants gratefully acknowledge the indication of the allowable subject matter. Based on the remarks below, Applicants have chosen not to rewrite claims 4, 9-15, 19-20, 26-27, and 29 in independent form at this time

Claim Rejection under 35 U.S.C. §102

Claims 7, 16 and 17 have been rejected under 35 U.S.C. §102(a) as allegedly being anticipated by "Octree Approximation and Compression Methods," *Proceedings of First International Symposium on 3D Data Processing Visualization and Transmission*, IEEE Computer Society, pp. 1-10 (June 2002) to Samet *et al.* ("Samet"). Applicants respectfully traverse the rejection.

Claim 7 recites, among other features, "(a) generating three-dimensional object data having a tree structure of a predetermined depth in which nodes include attached labels indicating their respective types, the types comprising nodes having sub-nodes, nodes having all voxels located in the background, nodes having all

voxels located where objects exist, and nodes at the predetermined depth having voxels located where objects exist and in the background."

The specification of the instant application describes a process for representing volume data by an octree and classifying nodes of the octree into four different categories. (Specification at page 10, lines 19-20). If a bounding volume contains an object, a root node is labeled "S" and the bounding volume is divided into eight identical sub-volumes. (Specification at page 10, lines 21-23). If a sub-volume only includes black voxels or only includes white voxels, a corresponding node is labeled "B" or "W," respectively, otherwise the node corresponding to the sub-volume is labeled "S" and the sub-volume is further divided into eight identical smaller parts. (Specification at page 10, lines 23-26).

The specification of the instant application provides that this process is repeated *until a node at a predetermined depth of the octree is reached.* (Specification at page 10, lines 26-2, emphasis added). If the node *at the predetermined depth of the octree* includes black voxels as well as white voxels, the node is labeled "P" and voxel values included in the node can be encoded using a prediction-by-partial-matching (PPM) method. (Specification at page 10, lines 27-29, emphasis added). For example, FIGS. 3B-3D illustrate exemplary octree structures of a predetermined depth in which nodes at the predetermined depth having voxels located where objects exist and in the background are labeled "P."

Samet, on the other hand, describes constructing a region octree by repeatedly subdividing a $2^n \times 2^n \times 2^n$ array of voxels into octants, suboctants, etc., *until obtaining blocks which consist of a single value.* (Samet at page 2, section 2 "Octree Representation"). Samet teaches that leaf nodes correspond to those

blocks of the array for which no further subdivision is necessary. (Samet at page 2, section 2 "Octree Representation"). Samet also teaches that blocks corresponding to *non-leaf nodes* are labeled GRAY. (Samet at page 2, section 2 "Octree Representation"). Thus, as non-leaf nodes that correspond to those blocks of the array for which further subdivision is required, GRAY nodes do not consist of a single value and, therefore, *cannot be located at the depth of the octree*. For example, FIG. 2 of Samet illustrates an exemplary tree representation in which internal/non-leaf nodes are depicted as white squares and are not located at the depth of the octree. For at least these reasons, Applicants respectfully disagree with the Office that the internal/non-leaf nodes labeled GRAY in Samet are "nodes at the predetermined depth having voxels located where objects exist and in the background." (Final Office action at page 3).

Because Samet does not teach "nodes at the predetermined depth having voxels located where objects exist and in the background," Samet does not anticipate claim 7. Accordingly, for at least these reasons, Applicants respectfully request that the §102(a) rejection of claim 7 and of claims 16 and 17, which depend therefrom, be withdrawn.

Claim Rejections under 35 U.S.C. §103

Claims 1, 6, 24, 28, 30 and 33

Claims 1, 6, 24, 28, 30 and 33 have been rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over U.S. Patent No. 5,123,084 to Prevost *et al.* ("Prevost") in view of "Octrees and their applications in image processing,"

Proceedings of IEEE Southeastcon '90, pp. 1116-1120 (April 1990) to Rambally *et al.* ("Rambally"). Applicants respectfully traverse the rejection.

Claim 1 recites a method of encoding three-dimensional object data that includes, among other features, "representing the voxel data by a tree structure of a predetermined depth in which nodes include attached labels indicating their respective types, the types comprising nodes having sub-nodes, nodes having all voxels located in the background, nodes having all voxels located where objects exist, and nodes at the predetermined depth having voxels located where objects exist and in the background."

As already described herein, the specification of the instant application describes a process for representing volume data that is repeated until a node at a predetermined depth of the octree is reached. (Specification at page 10, lines 26-2). Further, if the node *at the predetermined depth of the octree* includes black voxels as well as white voxels, the node is labeled "P" and voxel values included in the node can be encoded using a prediction-by-partial-matching (PPM) method. (Specification at page 10, lines 27-29, emphasis added).

Prevost, on the other hand, describes an octree structure with nodes labeled E (for "empty") to represent nodes that do not have properties and do not have children nodes, *P (for "partial") to represent nodes that have descendents*, some of which have properties, and F (for "full") to represent nodes having uniform properties but no descendents (i.e., leaf nodes). (Prevost at col. 3, line 57 to col. 4, line 3). Prevost further describes expanding the octree *until a level that no longer contains any "P" nodes* is reached. (Prevost at col. 4, lines 24-36). For example, FIG. 2D of Prevost illustrates an exemplary octree that is not expanded past the depth of level

2, since level 2 no longer has any "P" nodes. Thus, "P" nodes *are not located at the depth of the octree*.

Similarly, Rambally describes an octree whose nodes are either leaves or have eight children. (Rambally at page 1116, "Introduction"). The leaves are either BLACK or WHITE since they represent a portion of the object or surrounding space, respectively, and the nodes with eight children are referred to as GRAY nodes. (Rambally at page 1116, "Introduction"). Rambally further describes a process for representing an object based on successive subdivision of a $2^n \times 2^n \times 2^n$ array into octants *until cubes are obtained that are entirely BLACK or entirely WHITE*. (Rambally at page 1116, "Object Representation"). Rambally teaches that the corresponding octree has terminal nodes corresponding to those cubes of the array for which no further subdivision is necessary (i.e., these cubes are entirely BLACK or WHITE). (Rambally at page 1116, "Object Representation").

Rambally further teaches that the *GRAY nodes are non-terminal nodes requiring further decomposition because they consist of both BLACK and WHITE voxels*. (Rambally at page 1116, "Object Representation"). Thus, because they consist of both BLACK and WHITE voxels, the GRAY nodes *cannot be located at the depth of the octree*. For example, FIG. 2C of Rambally illustrates an exemplary octree in which terminal nodes are depicted as BLACK or WHITE squares, while non-terminal nodes, or GRAY nodes, are illustrated with circles. For at least these reasons, Applicants respectfully disagree with the Office that the GRAY nodes described in Rambally are "nodes at the predetermined depth having voxels located where objects exist and in the background." (Final Office action at page 5).

Because neither Prevost nor Rambally, either alone or in combination, teaches or suggests "nodes at the predetermined depth having voxels located where objects exist and in the background," as recited in claim 1, claim 1 is patentable over Prevost and Rambally. Accordingly, Applicants respectfully request that the rejection under §103(a) of claim 1 and of claims 6 and 30, which depend therefrom, be withdrawn.

For reasons analogous to those presented for claim 1, independent claim 24 is patentable over Prevost and Rambally. At a minimum, no combination of Prevost and Rambally teaches or suggests "the node type information describes nodes having sub-nodes and nodes at a predetermined depth of a tree structure having voxels located where objects exist and in a background," as recited in claim 24. Accordingly, Applicants respectfully request that the rejection under §103(a) of claim 24 and of claim 33, which depends therefrom, be withdrawn.

Further, for reasons analogous to those presented for claim 1, independent claim 28 is patentable over Prevost and Rambally. At a minimum, no combination of Prevost and Rambally teaches or suggests "the node type information describes nodes having sub-nodes and nodes at a predetermined depth of a tree structure having voxels located where objects exist and in a background," as recited in claim 28. Accordingly, Applicants respectfully request that the rejection under §103(a) of claim 28 be withdrawn.

Claims 18, 21, 22 and 31

Claims 18, 21, 22 and 31 have been rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Samet, as applied to claim 7. Applicants respectfully traverse the rejection.

For reasons analogous to those presented for claim 7, independent claim 18 is patentable over Samet. At a minimum, Samet does not teach or suggest "nodes at the predetermined depth having voxels located where objects exist and in the background," as recited in claim 18. Accordingly, Applicants respectfully request that the rejection under §103(a) of claim 18, and of claims 21 and 22, which depend therefrom, be withdrawn.

Similarly, for reasons analogous to those presented for claim 7, claim 31, which depends therefrom, is patentable over Samet. At a minimum, Samet does not teach or suggest "nodes at the predetermined depth having voxels located where objects exist and in the background," as recited in parent claim 7. Accordingly, Applicants respectfully request that the rejection under §103(a) of claim 31 be withdrawn.

Claim 8

Claim 8 has been rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Samet, as applied to claim 7, and further in view of "Implementing the PPM data compression scheme," *IEEE Transactions on Communications*, pp. 1917-1921 (Nov. 1990) to Moffat ("Moffat"). Applicants respectfully traverse the rejection.

For reasons analogous to those presented for claim 7, Applicants submit that claim 8, which depends therefrom, is patentable over Samet and that Moffat does not supply the teachings missing from Samet. At a minimum, no combination of Samet and Moffat teaches or suggests "nodes at the predetermined depth having voxels located where objects exist and in the background," as recited in parent claim 7. Accordingly, Applicants respectfully request that the rejection under §103(a) of claim 8 be withdrawn.

Claim 5

Claim 5 has been rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Prevost in view of Rambally, as applied to claim 1, and further in view of Samet. Applicants respectfully traverse the rejection.

For reasons analogous to those presented for claim 1, Applicants submit that claim 5, which depends from claim 1, is patentable over Prevost and Rambally and that Samet does not supply the teachings missing from Prevost and Rambally. As already described herein, Samet teaches constructing a region octree by repeatedly subdividing a $2^n \times 2^n \times 2^n$ array of voxels into octants, suboctants, etc., *until obtaining blocks which consist of a single value*, and further teaches that GRAY nodes are non-leaf nodes that require further subdivision. Thus, the GRAY nodes in Samet do not correspond to blocks which consist of a single value and, therefore, *cannot be located at the depth of the* octree. Thus, at a minimum, no combination of Prevost, Rambally, and Samet teaches or suggests "nodes at the predetermined depth having voxels located where objects exist and in the background," as recited in

parent claim 1. Accordingly, Applicants respectfully request that the rejection under §103(a) of claim 5 be withdrawn.

Claims 3, 23, 25 and 32

Claims 3, 23, 25 and 32 have been rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Prevost in view of Rambally, as applied to claims 1 and 24, and further in view of Moffat. Applicants respectfully traverse the rejection.

For reasons analogous to those presented for claim 1, Applicants submit that claim 3, which depends from claim 1, is patentable over Prevost and Rambally and that Samet does not supply the teachings missing from Prevost and Rambally. Again, as already described herein, GRAY nodes in Samet do not correspond to blocks which consist of a single value and, therefore, *cannot be located at the depth of the* octree. Thus, at a minimum, no combination of Prevost, Rambally, and Samet teaches or suggests "nodes at the predetermined depth having voxels located where objects exist and in the background," as recited in parent claim 1. Accordingly, Applicants respectfully request that the rejection under §103(a) of claim 3 be withdrawn.

For reasons analogous to those presented for claim 24, Applicants submit that claim 25, which depends from claim 24, is patentable over Prevost and Rambally and that Samet does not supply the teachings missing from Prevost and Rambally. At a minimum, no combination of Prevost, Rambally, and Samet teaches or suggests "the node type information describes nodes having sub-nodes and nodes at a predetermined depth of a tree structure having voxels located where objects exist

and in a background," as recited in parent claim 24. Accordingly, Applicants respectfully request that the rejection under §103(a) of claim 25 be withdrawn.

Similarly, for reasons analogous to those presented for claim 24, Applicants submit that independent claim 23 is patentable over Prevost and Rambally and that Samet does not supply the teachings missing from Prevost and Rambally. At a minimum, no combination of Prevost, Rambally, and Samet teaches or suggests "decoding a 'P' node if the node type information indicates that the current node is a node at a predetermined depth of a tree structure having voxels located where objects exist and in a background," as recited in claim 23. Accordingly, Applicants respectfully request that the rejection under §103(a) of claim 23 and of claim 32, which depends therefrom, be withdrawn.

CONCLUSION

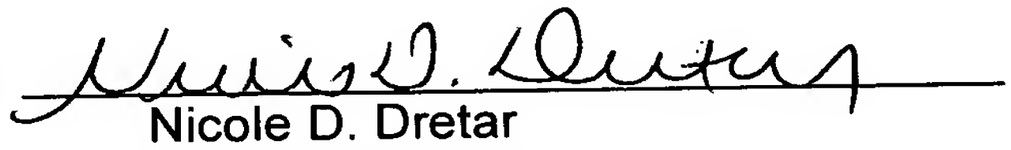
It is believed that this Response and Amendment requires no fee. However, if fees are required for any reason, please charge Deposit Account No. 02-4800 the necessary amount.

In the event that there are any questions concerning this paper, or the application in general, the Examiner is respectfully urged to telephone Applicants' undersigned representative so that prosecution of the application may be expedited.

Respectfully submitted,

BUCHANAN INGERSOLL & ROONEY PC

Date: January 31, 2007

By: 
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